6. PRELIMINARY ENGINEERING EVALUATION

6.0 PRELIMINARY ENGINEERING EVALUATION

6.1 Introduction

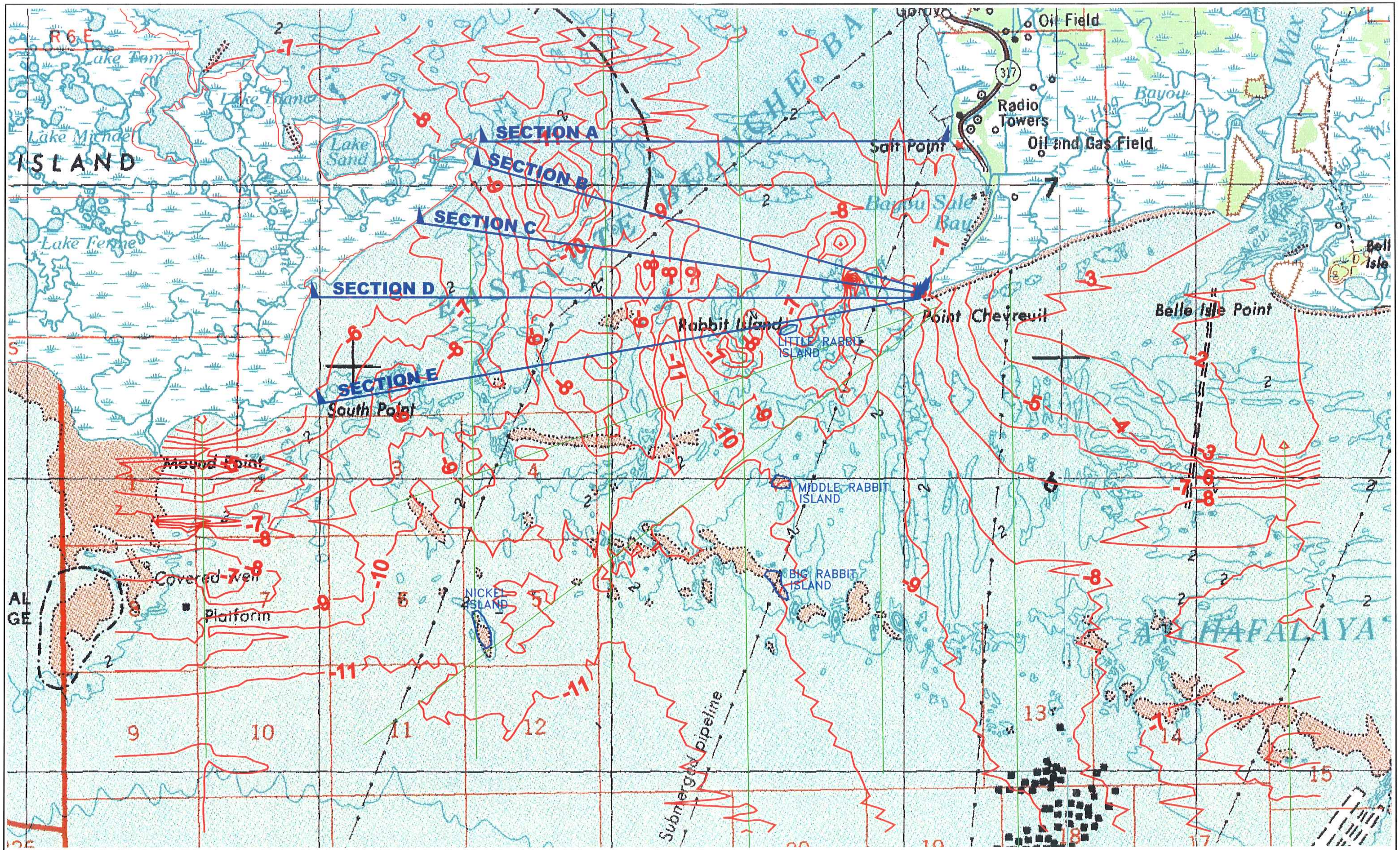
It was decided early in the project to concentrate on the necessary components of the modeling portion of the study to determine whether project objectives could be realized. The engineering evaluation of the Acadiana Bays Reef Restoration Project was therefore somewhat limited in scope. The engineering component consisted of a preliminary engineering assessment of the feasibility of constructing a reef-like structure in the bay system and estimating structure cross sections and approximate costs of the structures. The cross section derivation was based on the geotechnical evaluation of bay bottom conditions and bathymetric survey data collected during the study. Attempts were made to optimize the cost estimates using different reef structure alignments, different materials of construction, and different construction techniques such as structure foundation preparation (deep soil mixing).

6.2 Use of Survey Data

Bathymetric survey data was generated by John Chance Land Surveys, Inc. for nineteen pre-selected transects throughout the bay system as identified in Section 3 of this report. The 3-d data points derived by JCLS and received at NELSON were entered into AutoCad and processed using Eagle Point Surface Modeling and Surfer contouring software packages. Subsequent 2-D contour plots were elevated in AutoCad to a 3-D format.

6.3 Derivation of Alternate Reef Alignments

Initially reef cross sections were generated along five potential alignments across East Cote Blanche Bay generally from Point Chevrieul westward towards Marsh Island. These alignments were initially named Section A, Section B, Section C, Section D, and Section E and are shown in Figure 6-1. The bottom profile of these alignments are included in Appendix C. Of these five initial transects, Section D, the alignment extending from Point Chevreuil to Marsh Island at a 270 degree heading was chosen for further evaluation and is hereinafter referred to as Reef B. Reef B alignment was selected as it posed the opportunity for complete blockage of fresh water and turbidity originating



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ACADIANA BAYS REEF RESTORATION FEASABILITY STUDY

FIGURE 6-1
INITIAL REEF ALIGNMENTS

JOB NO.	DRAWING No.	REV.
20030175	—	0

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from the Atchafalaya River and Wax Lake Outlet into the western bays. This alignment also offered the potential least cost of the five alignments as it had the lowest derived fill volumes necessary for construction. Later, an additional transect was suggested by the Acadiana Bays Association extending 225 degrees southwest from Point Chevreuil and is referred to as Reef A. This alignment attempted to make maximum utilization of existing and former reef and island locations to minimize the amount of fill. Figure 6-2 exhibits the location of Reef alternative alignments A and B. Longitudinal sections of the bathometry of the two alignments are shown in Figures 6-3. It should be noted that the section shown in Figure 6-3 for reef alignment A does not show evidence of these remnant reefs or islands. This is undoubtedly caused by the fact that when the bathymetric surveying program was conducted earlier in the project the emphasis was on detailing bathymetry between Point Chevrieul and Marsh Island as that was where the reef structures were assumed to be placed. More precise surveying of alignment A would probably reveal these remnant structures and result in a lower fill volumes calculated for a reef at this or a nearby location.

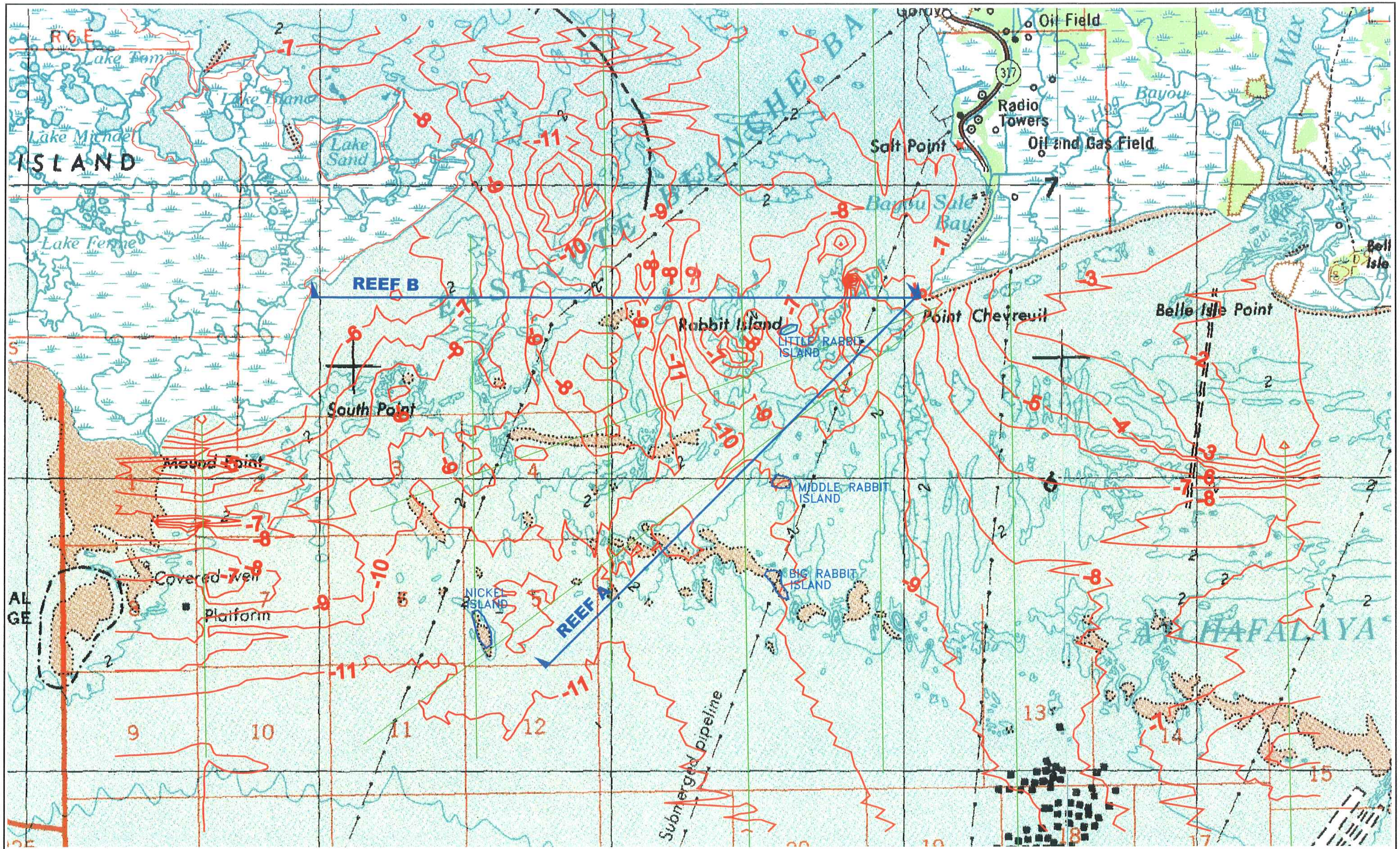
6.4 Reef Geometry

Foundation width and fill requirements were determined at various fill heights at effective (submerged conditions) fill unit weights of 70 and 86 pounds per cubic foot (pcf) using those "Embankment Fill Height vs Fill Unit Weight for Foundation Width" curves prepared by Lourie Consultants for the anticipated offshore soil conditions. These two unit weights were selected as representing possible reef construction material of sandy and rock or concrete material, respectively. These curves are included in the Geotechnical Report found in Appendix B. These curves reflect very conservative assumptions of the strength of the bay bottom soils and probably cause an overprediction of necessary fill volumes and resulting cost estimates for the structures. If the project progresses past the modeling and preliminary engineering phase then actual geotechnical data will be acquired to support the soil conditions assumptions.

Two cases were investigated:

1.) Placement of the top of the reef at the water surface.

2.) Placement of the top of the reef at a depth of (-)3 feet.



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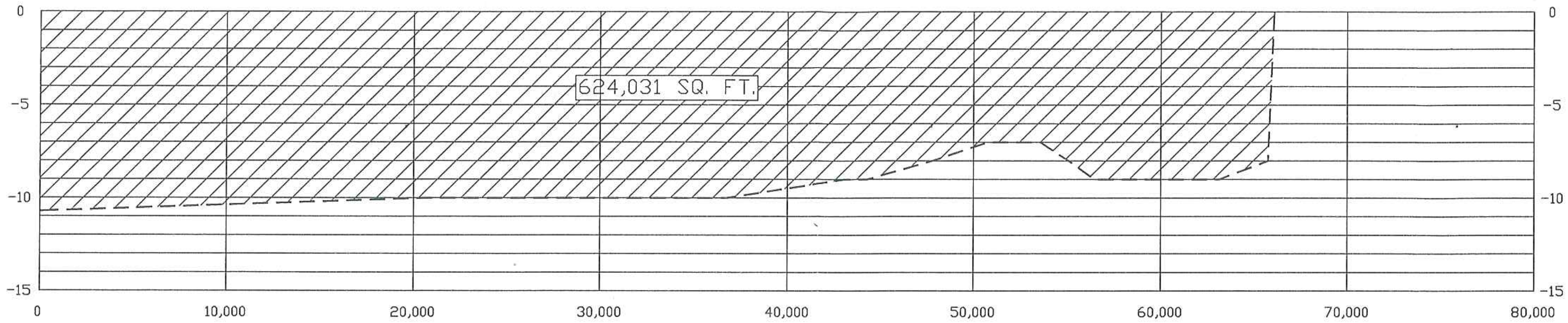
ACADIANA BAYS REEF RESTORATION FEASABILITY STUDY

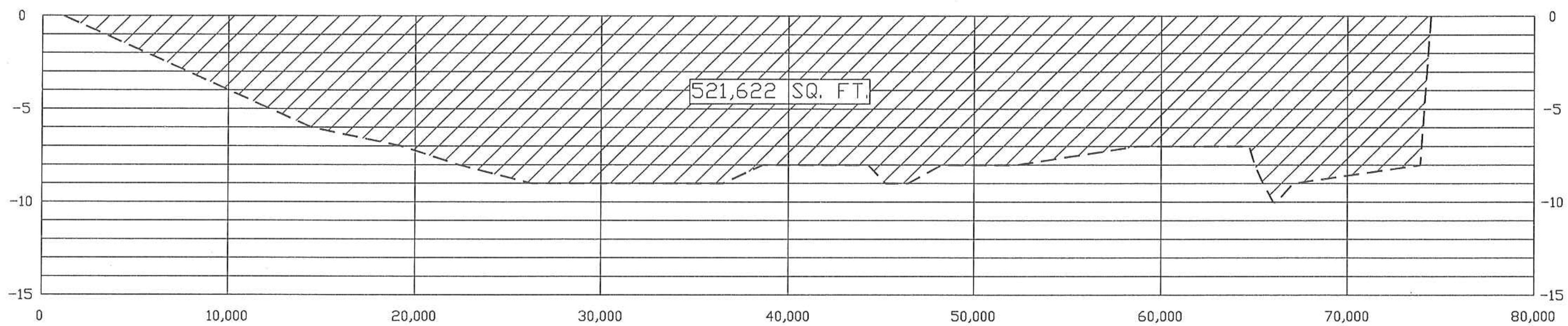
FIGURE 6–2
ALTERNATE REEF ALIGNMENTS

JOB NO.	DRAWING No.	REV.
20030175	—	0

ACAD FILE: baseplan.DWG



REEF A



REEF B

NOTES:
1. VERTICAL EXAGGERATION– 1000x
2. DATUM NAVD 88

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ACADIANA BAYS REEF RESTORATION FEASABILITY STUDY

FIGURE 6–3
BATHYMETRIC SECTIONS OF ALTERNATE REEF ALIGNMENTS

JOB NO.	DRAWING No.	REV.
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The fill requirements for the resulting structure lengths at varying depths were integrated for each fill material and base case investigated to determine the estimated net fill requirements. The estimated fill requirements are shown in Tables 6-1 and 6-2 for fill submerged unit weights of 70 and 86 pcf. Fill requirements for the original five alignments, Sections A – E, with a submerged unit weight of 70 pcf are included in Appendix E.

6.5 Deep Soil Mixing

Because of the very wide base dimensions of the reef alignments caused by the poor soil conditions it was decided to investigate other means of reef construction, notably improving the base foundation for the structure. One means of doing this is to use deep soil mixing to improve soil strengths allowing for a more compact reef cross section. The deep mixing method is an in situ soil treatment technology whereby the soil is blended with cementitious and/or other materials. These materials are referred to as binders and can be introduced in dry or slurry form. They are injected through hollow, rotated mixing shafts tipped with some type of cutting tool. In some methods, the mixing action is enhanced by simultaneously injecting fluid grout at high pressure through nozzles in the mixing or cutting tools.

The cemented soil material that is produced generally has a higher strength, lower permeability and lower compressibility than the native soil. These treated soils would then be able to support a structure with a smaller cross sectional area and still maintain slope stability. The volume of 86 pcf material necessary to construct the alternative reefs to elevation 0.0 and the required deep soil mixing volume are shown in Table 6-3. The exact properties obtained would reflect characteristics of the native soil, the construction variables (principally the mixing method), the operational parameters, and the binder characteristics.

6.6 Derivation of Typical Reef Sections

Reef designs were evaluated for each material type considered and are summarized as follows:

TABLE 6-1
ACADIANA BAYS PROJECT
REEF VOLUME REQUIRED FOR SUBMERGED FILL WEIGHT OF 70 PCF

TOP OF REEF STRUCTURE AT EL. 0.00									
FILL HEIGHT	BASE WIDTH	AREA	FILL WEIGHT	REEF A			REEF B		
(FT.)	(FT.)	(SQ. FT.)	(PCF)	LENGTH (FT.)	VOLUME (CF)	WEIGHT (LBS)	LENGTH (FT.)	VOLUME (CF)	WEIGHT (LBS)
0-1	30	15	70	41	610	42,700	2,300	34,500	2,410,000
1-2	63	63	70	41	2,560	179,000	2,300	145,000	10,100,000
2-3	92	138	70	41	5,610	393,000	2,300	317,000	22,200,000
3-4	125	250	70	41	10,200	712,000	2,300	574,000	40,200,000
4-5	155	388	70	41	15,800	1,100,000	2,300	890,000	62,300,000
5-6	188	564	70	41	22,900	1,610,000	2,300	1,300,000	90,700,000
6-7	215	753	70	41	30,600	2,140,000	4,860	3,660,000	256,000,000
7-8	245	980	70	7,320	7,180,000	502,000,000	15,800	15,500,000	1,080,000,000
8-9	265	1,193	70	15,400	18,400,000	1,280,000,000	37,300	44,500,000	3,110,000,000
9-10	330	1,650	70	22,400	37,000,000	2,590,000,000	1,610	2,660,000	186,000,000
10-11	340	1,870	70	20,600	38,600,000	2,700,000,000	0	0	0
				TOT. VOL. (CY)	3,750,000		TOT. VOL. (CY)	2,570,000	

TOP OF REEF STRUCTURE AT EL. -3.00									
FILL HEIGHT	BASE WIDTH	AREA	FILL WEIGHT	REEF A			REEF B		
(FT.)	(FT.)	(SQ. FT.)	(PCF)	LENGTH (FT.)	VOLUME (CF)	WEIGHT (LBS)	LENGTH (FT.)	VOLUME (CF)	WEIGHT (LBS)
0-1	30	15	70	41	610	42,700	2,300	34,500	2,410,000
1-2	63	63	70	41	2,560	179,000	2,300	145,000	10,100,000
2-3	92	138	70	41	5,610	393,000	2,300	317,000	22,200,000
3-4	125	250	70	41	10,200	712,000	4,860	1,220,000	85,100,000
4-5	155	388	70	7,320	2,840,000	199,000,000	15,800	6,130,000	429,000,000
5-6	188	564	70	15,400	8,680,000	608,000,000	37,300	21,000,000	1,470,000,000
6-7	215	753	70	22,400	16,900,000	1,180,000,000	1,610	1,210,000	84,800,000
7-8	245	980	70	20,600	20,200,000	1,410,000,000	0	0	0
				TOT. VOL. (CY)	1,800,000		TOT. VOL. (CY)	1,110,000	

TABLE 6-2
ACADIANA BAYS PROJECT
REEF VOLUME REQUIRED FOR SUBMERGED FILL WEIGHT OF 86 PCF

TOP OF REEF STRUCTURE AT EL. 0.00									
FILL HEIGHT	BASE WIDTH	AREA	FILL WEIGHT	REEF A			REEF B		
(FT.)	(FT.)	(SQ. FT.)	(PCF)	LENGTH (FT.)	VOLUME (CF)	WEIGHT (LBS)	LENGTH (FT.)	VOLUME (CF)	WEIGHT (LBS)
0-1	37	19	86	41	752	64,700	2,300	42,500	3,650,000
1-2	75	75	86	41	3,050	262,000	2,300	172,000	14,800,000
2-3	110	165	86	41	6,710	577,000	2,300	379,000	32,600,000
3-4	150	300	86	41	12,200	1,050,000	2,300	689,000	59,300,000
4-5	188	470	86	41	19,100	1,640,000	2,300	1,080,000	92,800,000
5-6	225	675	86	41	27,400	2,360,000	2,300	1,550,000	133,000,000
6-7	260	910	86	41	37,000	3,180,000	4,860	4,430,000	381,000,000
7-8	300	1,200	86	7,320	8,790,000	756,000,000	15,800	19,000,000	1,630,000,000
8-9	335	1,508	86	15,400	23,200,000	2,000,000,000	37,300	56,200,000	4,830,000,000
9-10	375	1,875	86	22,400	42,100,000	3,620,000,000	1,610	3,020,000	260,000,000
10-11	410	2,255	86	20,600	46,500,000	4,000,000,000	0	0	0
				TOT. VOL. (CY)	4,470,000		TOT. VOL. (CY)	3,200,000	

ACADIANA BAYS PROJECT

TOP OF REEF STRUCTURE AT EL. -3.00									
FILL HEIGHT	BASE WIDTH	AREA	FILL WEIGHT	REEF A			REEF B		
(FT.)	(FT.)	(SQ. FT.)	(PCF)	LENGTH (FT.)	VOLUME (CF)	WEIGHT (LBS)	LENGTH (FT.)	VOLUME (CF)	WEIGHT (LBS)
0-1	37	19	86	41	752	64,700	2,300	42,500	3,650,000
1-2	75	75	86	41	3,050	262,000	2,300	172,000	14,800,000
2-3	110	165	86	41	6,710	577,000	2,300	379,000	32,600,000
3-4	150	300	86	41	12,200	1,050,000	4,860	1,460,000	125,000,000
4-5	188	470	86	7,320	3,440,000	296,000,000	15,800	7,430,000	639,000,000
5-6	225	675	86	15,400	10,400,000	893,000,000	37,300	25,200,000	2,160,000,000
6-7	260	910	86	22,400	20,400,000	1,760,000,000	1,610	1,460,000	126,000,000
7-8	300	1,200	86	20,600	24,700,000	2,130,000,000	0	0	0
				TOT. VOL. (CY)	2,190,000		TOT. VOL. (CY)	1,340,000	

TABLE 6-3
ACADIANA BAYS PROJECT
MODIFIED REEF VOLUME REQUIRED USING DEEP SOIL MIXING TECHNOLOGIES

MODIFIED STRUCTURE AT EL. 0.00 USING DEEP SOIL MIXING									
FILL HEIGHT	BASE WIDTH	AREA	FILL WEIGHT	REEF A			REEF B		
(FT.)	(FT.)	(SQ. FT.)	(PCF)	LENGTH (FT.)	VOLUME (CF)	WEIGHT (LBS)	LENGTH (FT.)	VOLUME (CF)	WEIGHT (LBS)
0-1	11	5	86	41	193	16,600	2,300	10,900	938,000
1-2	17	19	86	41	762	65,600	2,300	43,100	3,700,000
2-3	23	39	86	41	1,580	135,000	2,300	89,000	7,650,000
3-4	29	65	86	41	2,630	226,000	2,300	149,000	12,800,000
4-5	35	97	86	41	3,930	338,000	2,300	222,000	19,100,000
5-6	41	135	86	41	5,480	471,000	2,300	309,000	26,600,000
6-7	47	179	86	41	7,270	625,000	4,860	869,000	74,800,000
7-8	53	229	86	7,320	1,670,000	144,000,000	15,800	3,620,000	311,000,000
8-9	59	285	86	15,400	4,380,000	377,000,000	37,300	10,600,000	913,000,000
9-10	65	347	86	22,400	7,780,000	669,000,000	1,610	558,000	48,000,000
10-11	71	415	86	20,600	8,550,000	736,000,000	0	0	0
				TOT. VOL. (CY)	830,000		TOT. VOL. (CY)	610,000	

DEEP SOIL MIXING (30% BASE AREA TREATED)									
DEPTH	WIDTH	AREA	30% AREA	REEF A			REEF B		
(FT.)	(FT.)	(SQ. FT.)	(SQ. FT.)	LENGTH (FT.)	VOLUME (CF)	VOLUME (CY)	LENGTH (FT.)	VOLUME (CF)	VOLUME (CY)
25	31	775	233	41	9,450	350	2,300	534,000	19,800
25	37	925	278	41	11,300	418	2,300	637,000	23,600
25	43	1,075	323	41	13,100	486	2,300	741,000	27,400
25	49	1,225	368	41	14,900	553	2,300	844,000	31,300
25	55	1,375	413	41	16,800	621	2,300	947,000	35,100
25	61	1,525	458	41	18,600	689	2,300	1,050,000	38,900
25	67	1,675	503	41	20,400	757	4,860	2,440,000	90,500
25	73	1,825	548	7,320	4,010,000	148,000	15,800	8,660,000	321,000
25	79	1,975	593	15,400	9,120,000	338,000	37,300	22,100,000	818,000
25	85	2,125	638	22,400	14,300,000	530,000	1,610	1,030,000	38,000
25	91	2,275	683	20,600	14,100,000	521,000	0	0	0
					TOT. VOL. (CY)	1,540,000		TOT. VOL. (CY)	1,440,000

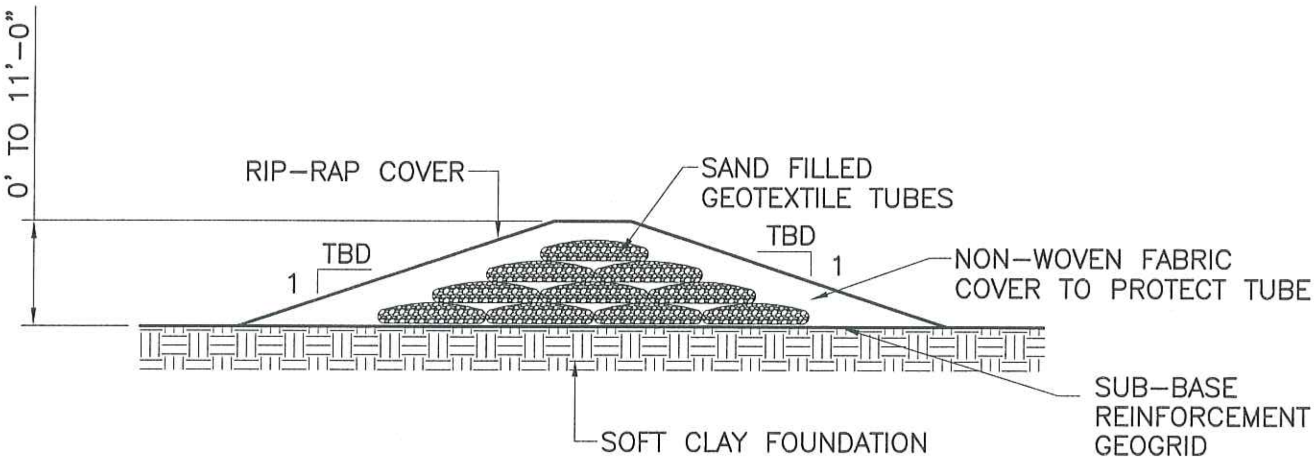
Construction of an offshore barrier using fine grained dredged material is limited due to the material's high water content, low strength, low angle of repose and difficulty in control of placement and migration of the material. Containment of dredged material in geotextile tubes, bags or containers makes this option feasible by aiding in placement and constructability. The containers are typically constructed by two sheets of geotextile sewn along the edges and take on the shape of a pillow when filled with the dredged material. The containers could be filled in place with materials locally dredged or barged to the site. The tubes could be stacked to meet the depth requirements along the cross section. The stacked tubes could be connected to each other for stability and armored with rip-rap. A typical section illustrating construction of the reef using contained dredged material is shown in Figure 6-4.

Construction of a reef from concrete rubble or limestone rip-rap is limited by the weight of the material on the soft underlying soils. A large cross section of material is required to allow for settlement and failures during construction. A typical section illustrating construction of the reef using rock or rip-rap is shown in Figure 6-5.

The design of the reef proposed for the application of deep soil mixing to strengthen the base soils was developed assuming achievement of soil strengths of approximately 200 psf . This design greatly reduces the quantity of the rock-like material required for stability. The soil below the reef will be treated within a grid system that will be applied to approximately 30% of the underlying area. The footprint would extend 10' beyond the toe of the slope for the length of the reef and extend to a depth of 25'. Advantages to this reef design include more efficient use of material, fewer failures during construction and less areas of uncertainty presented by the weak soil foundations. A typical section using deep soil mixing and construction of the reef using rock-type material overlaying it is shown in Figure 6-6.

6.7 Construction Costs

Costs were developed for each case for the A and B alignments using volumes generated for the fill unit weights. These costs include in place materials and mobilization of all dredging equipment or barges, depending on material used. For the dredged material, it was assumed that the material will be dredged locally and pumped directly to the site.



SECTION:
CONSTRUCTED REEF
RIP-RAP COVERED GEOTEXTILE TUBE

SCALE: 1" = 20'

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FIGURE 6-4
TYP. REEF SECTION USING SAND MATERIAL

DATE	SCALE	JOB NO.	DRAWING NO.
2/14/06	SHOWN	20030175	FIGURE 6-4
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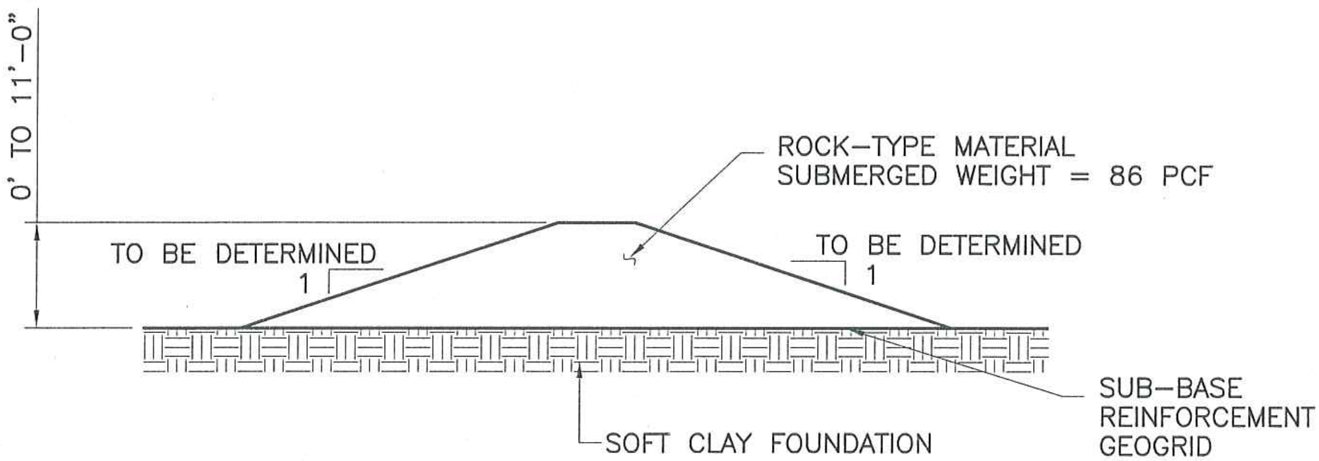

SECTION: CONSTRUCTED REEF UNIMPROVED FOUNDATION SOILS

SCALE: 1" = 20'

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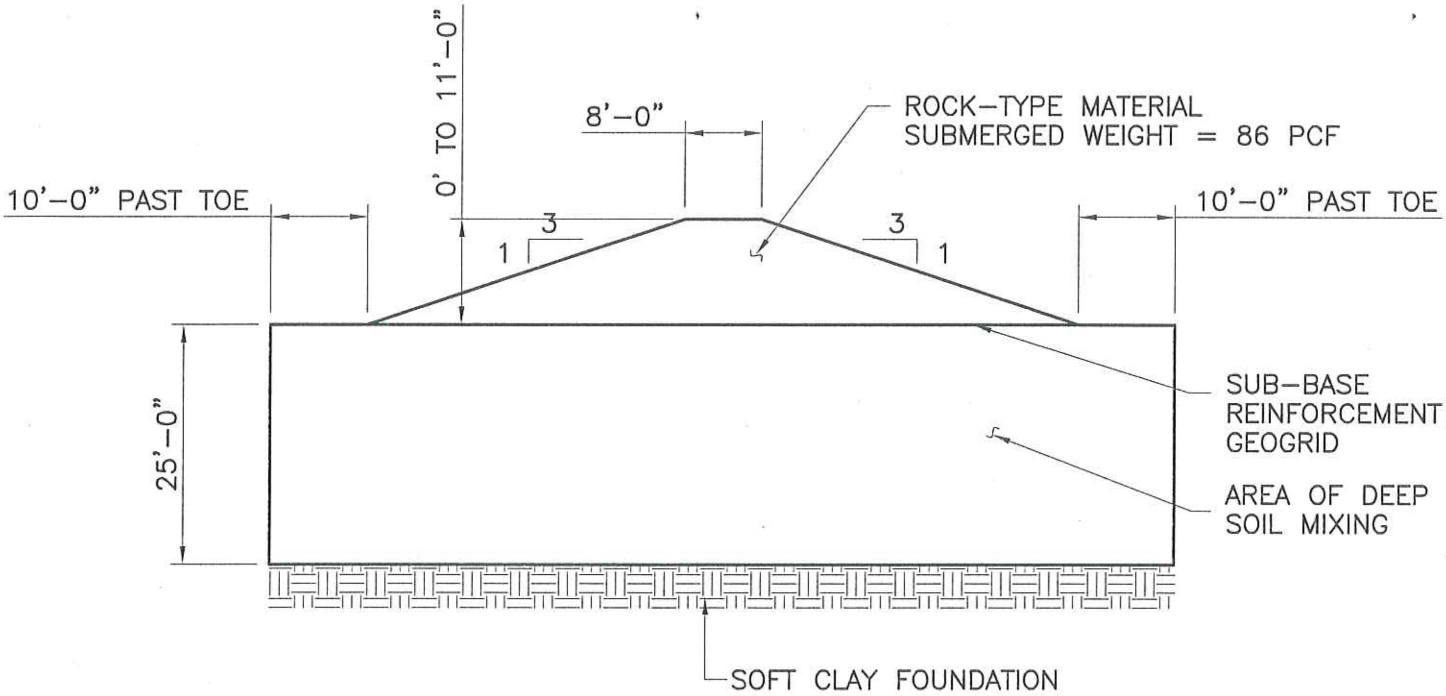
FIGURE 6-5
TYP. REEF SECTION W/ UNIMPROVED FOUNDATION

DATE	SCALE	JOB NO.	DRAWING NO.
2/14/06	SHOWN	20030175	FIGURE 6-5

DESIGNED BY: J.E. REGISTRATION NO. . STATE: .

2/14/2006 9:48 AM P:\20030175\4500 CD\REPORT\FIGURES 6-4_5_6.DWG



SECTION: CONSTRUCTED REEF UTILIZING DEEP SOIL MIXING STRENGTHENED SUB-BASE

SCALE: 1" = 20'

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FIGURE 6-6
TYP. REEF SECTION W/ IMPROVED FOUNDATION

DATE	SCALE	JOB NO.	DRAWING NO.
2/14/06	SHOWN	20030175	FIGURE 6-6

DESIGNED BY: J.E. REGISTRATION NO. . STATE: .

2/14/2006 9:49 AM P:\20030175\4500 CD\REPORT\FIGURES 6-4_5_6.DWG

Barging the material in would increase the material cost by 50%. For the rock material, limestone was assumed to be barged to the site. Rubble would be more variable in cost and availability, and would likely be more expensive. These cost estimates are shown in Tables 6-4 through 6-6 for the three alternate construction approaches. Table 6-7 summarizes the required volume of material and related cost for each alternative.

6.8 Review of Alternate Construction Material

6.8.1 Potential Sources of Dredged Material

The project team also evaluated alternative sources of material to use in reef construction. A potential source of construction materials can be obtained from the maintenance dredging of the Atchafalaya River, located approximately 16 miles east of Point Chevreuil. The Bar Channel Reach is an 18 mile reach that extends past the Atchafalaya Bay into the Gulf of Mexico and is dredged annually producing 9 – 11 million cubic yards of sand with lighter silts and clays. Historical data of the material dredged from this location indicates an average quantity of sand of 5.9%, with a maximum of 19%. The Bay Channel Reach is dredged about every 1.5 years producing 1 - 2 million cubic yards of material that is beneficially used for wetland development. Historical data of the material dredged from this location indicates an average quantity of sand of 4%, with a maximum of 5.4%. The Horseshoe Reach is dredged annually producing 1 million cubic yards of material that is beneficially used for wetland development. Historical data of the material dredged from this location indicates an average quantity of sand of 5.2%, with a maximum of 18.5%.

Bayous Chene, Boeuf and Black feed into the Atchafalaya River and are dredged on an as needed basis generally every 10, 30 and 15 years, respectively and are capable of producing 1.5 – 2 million cubic yards of material. The materials dredged from those bayous are used for upland confined wetland development. Historical data of the material dredged from this location indicates an average quantity of sand of 5.2%, with a maximum of 46.9%. GIWW Wax Lake Outlet is the closest source in proximity of the site, just 6 miles east of Point Chevreuil. It is dredged 2 or 3 times annually producing around 200,000 cubic yards of material currently discharged into the open water. Historical data was not available for this location, although sediment compositions from

TABLE 6-4
ACADIANA BAYS PROJECT
ESTIMATED PROJECT COST - 70 PCF MATERIAL

CONSTRUCTION MATERIAL WITH SUBMERGED FILL WEIGHT OF 70 PCF W/ ARMOR PROTECTION

	FILL WEIGHT* (PCF)	VOLUME (CF)**	VOLUME (CY)**	WEIGHT (TONS)	COST/CY	COST/TON	COST
TOP OF REEF STRUCTURE AT EL. 0.00							
REEF A							
MATERIAL (INCLUDING GEOTEXTILE TUBES)	132	128,000,000	4,740,000	8,470,000	$25.00		$119,000,000.00
MATERIAL (ARMOR)	148	12,800,000	474,000	947,000		$38.00	$36,000,000.00
MOBILIZATION (LUMP SUM)							$1,000,000.00
TOTAL CONSTRUCTION COST							**$155,000,000.00**
REEF B							
MATERIAL (INCLUDING GEOTEXTILE TUBES)	132	87,800,000	3,250,000	5,810,000	$25.00		$81,300,000.00
MATERIAL (ARMOR)	148	8,780,000	325,000	650,000		$38.00	$24,700,000.00
MOBILIZATION (LUMP SUM)							$1,000,000.00
TOTAL CONSTRUCTION COST							**$107,000,000.00**
TOP OF REEF STRUCTURE AT EL. -3.00							
REEF A							
MATERIAL (INCLUDING GEOTEXTILE TUBES)	132	61,600,000	2,280,000	4,080,000	$25.00		$57,000,000.00
MATERIAL (ARMOR)	148	6,160,000	228,000	456,000		$38.00	$17,300,000.00
MOBILIZATION (LUMP SUM)							$1,000,000.00
TOTAL CONSTRUCTION COST							**$75,300,000.00**
REEF B							
MATERIAL (INCLUDING GEOTEXTILE TUBES)	132	37,800,000	1,400,000	2,500,000	$25.00		$35,000,000.00
MATERIAL (ARMOR)	148	3,780,000	140,000	280,000		$38.00	$10,600,000.00
MOBILIZATION (LUMP SUM)							$1,000,000.00
TOTAL CONSTRUCTION COST							**$46,600,000.00**

*UNSUBMERGED FILL WEIGHT
**INCLUDES 10% CONSOLIDATION AND 15% SETTLEMENT

TABLE 6-5
ACADIANA BAYS PROJECT
ESTIMATED PROJECT COST - 86 PCF MATERIAL

CONSTRUCTION MATERIAL WITH SUBMERGED FILL WEIGHT OF 86 PCF

	FILL WEIGHT* (PCF)	VOLUME (CF)**	VOLUME (CY)**	WEIGHT (TONS)	COST/TON	COST
TOP OF REEF STRUCTURE AT EL. 0.00						
REEF A						
MATERIAL	148	139,000,000	5,140,000	10,300,000	$38.00	$391,000,000.00
MOBILIZATION (LUMP SUM)						$100,000.00
TOTAL CONSTRUCTION COST						**$392,000,000.00**
REEF B						
MATERIAL	148	99,400,000	3,680,000	7,380,000	$38.00	$280,000,000.00
MOBILIZATION (LUMP SUM)						$100,000.00
TOTAL CONSTRUCTION COST						**$281,000,000.00**
TOP OF REEF STRUCTURE AT EL. -3.00						
REEF A						
MATERIAL	148	68,000,000	2,520,000	5,050,000	$38.00	$192,000,000.00
MOBILIZATION (LUMP SUM)						$100,000.00
TOTAL CONSTRUCTION COST						**$192,000,000.00**
REEF B						
MATERIAL	148	41,600,000	1,540,000	3,090,000	$38.00	$117,000,000.00
MOBILIZATION (LUMP SUM)						$100,000.00
TOTAL CONSTRUCTION COST						**$118,000,000.00**

*UNSUBMERGED FILL WEIGHT
**INCLUDES 15% SETTLEMENT

TABLE 6-6
ACADIANA BAYS PROJECT
ESTIMATED PROJECT COST - REEF WITH IMPROVED FOUNDATION

CONSTRUCTION MATERIAL WITH SUBMERGED FILL WEIGHT OF 86 PCF UTILIZING DEEP SOIL MIXING

	FILL WEIGHT* (PCF)	VOLUME (CF)	VOLUME (CY)	WEIGHT (TONS)	COST/CY	COST/TON	COST
MODIFIED STRUCTURE AT EL. 0.00							
REEF A							
MATERIAL	148	22,400,000	830,000	1,660,000		$38.00	$63,100,000.00
MOBILIZATION (LUMP SUM)							$100,000.00
SUBTOTAL CONSTRUCTION COST							**$63,200,000.00**
DEEP SOIL MIXING							
REEF A							
MATERIAL		41,600,000	1,540,000		$150.00		$231,000,000.00
MOBILIZATION (LUMP SUM)							$200,000.00
SUBTOTAL CONSTRUCTION COST							**$231,000,000.00**
TOTAL CONSTRUCTION COST							**$295,000,000.00**
MODIFIED STRUCTURE AT EL. 0.00							
REEF B							
MATERIAL	148	16,500,000	610,000	1,220,000		$38.00	$46,400,000.00
MOBILIZATION (LUMP SUM)							$100,000.00
SUBTOTAL CONSTRUCTION COST							**$46,500,000.00**
DEEP SOIL MIXING							
REEF B							
MATERIAL		38,900,000	1,440,000		$150.00		$217,000,000.00
MOBILIZATION (LUMP SUM)							$200,000.00
SUBTOTAL CONSTRUCTION COST							**$217,000,000.00**
TOTAL CONSTRUCTION COST							**$263,000,000.00**

*UNSUBMERGED FILL WEIGHT

TABLE 6-7
ACADIANA BAYS PROJECT
VOLUME SUMMARY

	REEF A		
ELEVATION	**FILL WEIGHT* (PCF)**	**VOLUME (CY)**	**COST**
TOP OF REEF STRUCTURE AT EL. 0.00	70	4,740,000	**$155,500,000.00**
	86	5,140,000	**$392,000,000.00**
	86 (DSM)	830,000	**$295,000,000.00**
TOP OF REEF STRUCTURE AT EL. -3.00	70	2,280,000	**$75,300,000.00**
	86	2,520,000	**$192,000,000.00**
	REEF B		
ELEVATION	**FILL WEIGHT* (PCF)**	**VOLUME (CY)**	**COST**
TOP OF REEF STRUCTURE AT EL. 0.00	70	3,250,000	**$107,000,000.00**
	86	3,680,000	**$281,000,000.00**
	86 (DSM)	610,000	**$263,000,000.00**
TOP OF REEF STRUCTURE AT EL. -3.00	70	1,400,000	**$47,000,000.00**
	86	1,540,000	**$118,000,000.00**

* SUBMERGED FILL WEIGHT

two samples in 1998 indicate the material dredged from this location consisted of approximately 20% sand, with the remainder clay and silt. With relatively low concentrations of sand in the dredged materials, a possible alternative would be to strengthen the material with a cement mixture. Further analysis of the dredged material would be required to make this determination. A summary of sediment compositions for dredged materials provided by the U.S. Army Corps of Engineers is included in Table 6-8 below.

TABLE 6-8
ACADIANA BAYS PROJECT
DREDGED MATERIAL SEDIMENT COMPOSITION

LOCATION	% SAND (MAX.)	% SAND (AVG.)	% SILT (AVG.)	% CLAY (AVG.)
BAYOU CHENE AND BOEUF	46.9	5.2	74.6	20.2
HORSHOE REACH	18.5	5.2	79.8	15.0
BAR CHANNEL	19.0	5.9	71.8	22.3
BAY CHANNEL	5.4	3.5	53.6	42.9

6.8.2 Concrete and Masonry Rubble

Concrete rubble from structure and roadway demolition can be used in some applications. First, however, the rubble would require sorting, and steps would need to be taken to ensure the concrete is not contaminated. The concrete or other inert aggregate material may then be useful for reef construction, shoreline protection along navigation channels or inland shorelines, scour protection at intakes/outfalls of diversion structures, base fill material for embankments, aggregate base material for roadway construction, fill for aggregate pile foundations, or fill for stone columns supporting other coastal structures.

Concrete debris may be best suited for covered, buried or submerged placement applications. Concrete debris coming from a variety of sources can have quite variable strength, durability and dimensions, potentially resulting in highly variable engineering properties of the concrete debris compared to harder, more uniform rock derived from stone/rock quarries. Special equipment will be needed to break the concrete into usable sizes and double, or even triple, handling will be required. The somewhat limited variability of the concrete thicknesses derived from the debris will mean that gradation (size distribution) and shape of the crushed concrete debris will fall within a rather narrow range of wave energy applications.

Ignoring the costs to retrieve, haul, stockpile, and place the material on projects, the costs to pre-process and crush the debris to usable gradations would cost approximately \$27/ton, compared to \$18/ton for quarry rock normally used on coastal restoration projects. A similar project in the Breton Sound area determined that concrete rubble was not feasible due to the transportation expense of double handling (trucking and barging) and concerns with availability of material. They used limestone rip-rap that was barged directly from mines in Kentucky and Missouri to the project location. An estimate from a local supplier for limestone rip/rap that is barged from Kentucky to New Orleans is approximately \$20 - \$25 per ton.